AbstractID: 9038 Title: Dose calculation on cone-beam scans: A correction algorithm for improved dosimetry

Purpose:
The introduction of cone-beam CT (CBCT) based IGRT has greatly improved our knowledge of patient anatomy during treatment. However, the calculation of dose distributions based on CBCT images is problematic, due to poor consistency of density calibration and image artefacts. A method for correcting CBCT images for use in dose calculations has been developed and implemented at our institution.

Method and Materials:
Post processing of the Elekta Synergy CBCT scans was performed to remove artefacts and spurious density variations. In the algorithm the pre-treatment CT scan was used as a reference for the density of regions in the CBCT image, providing a 'shading map' of the differences between the two. Smoothing of the shading map was performed to remove high frequency content. Testing of the correction algorithm compared density values for corresponding tissue types, certified that non-artefact density changes are maintained, and compared dose calculations based on corrected CBCT scans to pre-treatment CT calculations.

Results:
CBCT based dose calculations have been developed for prostate & lung treatment sites. For both sites the densities within the corrected CBCT scan were closer to those in the pre-treatment CT scan. In the example of prostate patients CT numbers in regions of fat and muscle tissue in the corrected CBCT were within 1% of the values in the planning CT, as opposed to 10-20% different for the un-corrected CBCT. The improvement in the density within the CBCT scan improves the dosimetric quality of the scan, providing a means of more automated treatment planning based on CBCT scans.

Conclusion:
A method for correcting CBCT scans for re-calculation of delivered dose has been developed and validated. The enhanced CBCT scans greatly improve the agreement between CBCT calculated doses and the expectation based on the planning CT.

Conflict of Interest (only if applicable):
None